

Effects of Biological Soil Crusts on Germination and Seedling Health of Key Successional Dune Plants *Deschampsia flexuosa* and *Morella pennsylvanica* on Cape Cod, MA

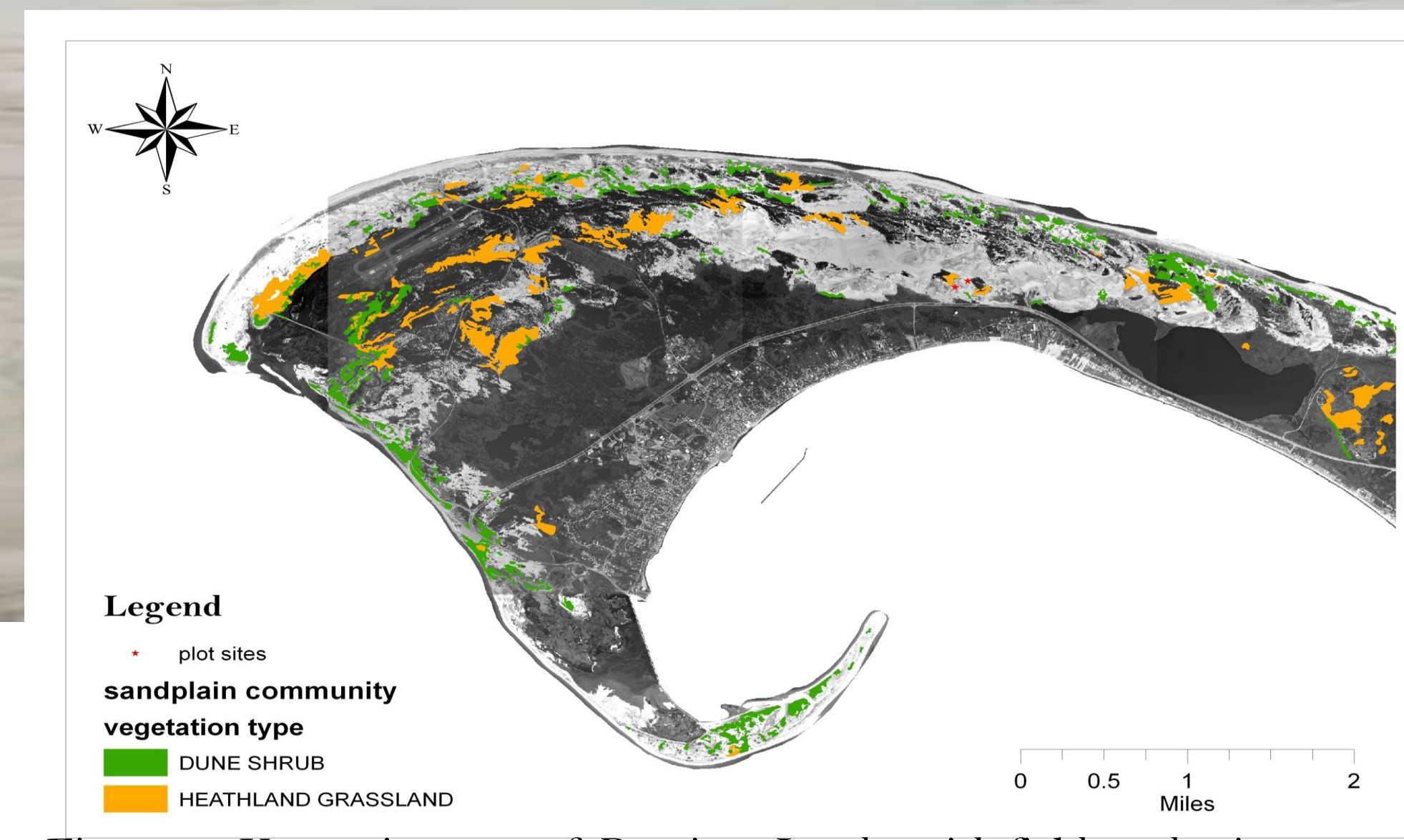


Figure 1. Vegetation map of Province Lands with field study sites

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BACKGROUND

Characterized as a large area of parabolic, migrating dunes with sparse vegetation cover, **the Province Lands sand dunes** are located at the tip of Cape Cod, Massachusetts, and are managed by Cape Cod National Seashore. **Biological soil crusts (BSCs)** cover hundreds of hectares throughout the Province Lands ².

BSCs are made up of communities of bacteria, algae, bryophytes, lichens, and fungi. They are found in arid and semi arid regions worldwide, as well as in some humid and temperate ecosystems like the Province Lands. Shrubs such as northern bayberry and beach plum, as well as American beach grass, wavy hairgrass, and globally rare heathlands are found throughout the dunes interspersed with BSCs^{3,4,5}.

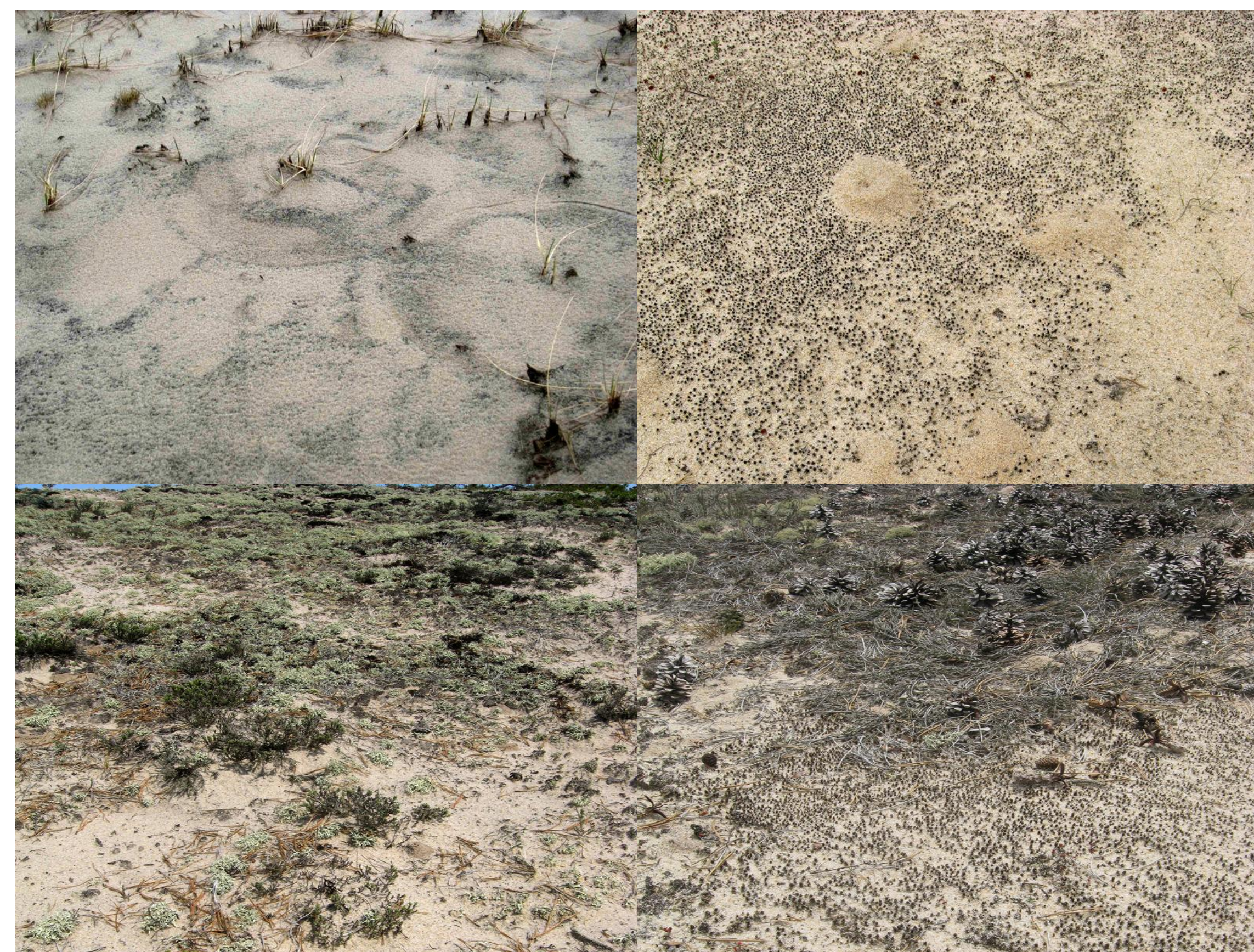


Figure 2. a.) Interstitial green algae (*K. flaccidum*) coexisting alone with beachgrass (*A. breviligulata*), b.) moss crusted soil, c.) moss and lichen community, and d.) moss and lichen community with accumulated litter (Photo Credit: a.) Rachel Thiet, b-d.) Alexis Doshas)

In the Province Lands' current state of early successional maritime forest, the dunes are susceptible to erosion and instability due to strong winds and rains from winter coastal storms, human impacts and projected sea level rise, increased precipitation and storm intensities associated with climate change. The presence of BSCs in the Province Lands sand dunes may be of some benefit to local macrophytic vegetation through water retention and nutrient additions¹².

The aim of this study is to explore how three BSC communities commonly found in the Province Lands - green algal crust, moss crust and moss and lichen crust, affect seed germination and seedling productivity of two key successional macrophytes in this ecosystem, *Deschampsia flexuosa* (wavy hairgrass) and *Morella pennsylvanica* (northern bayberry). These two species represent the two major vegetation types, heathlands and grasslands, found in the coastal sandplain communities of Cape Cod⁶. *Morella pennsylvanica* is a nitrogen fixing shrub which contributes N to the nutrient poor dune ecosystem, and the resilient *Deschampsia flexuosa* stabilizes dunes and protects against erosion.

EXPERIMENTAL DESIGN

Concurrent field and laboratory studies will be conducted over the 2011 growing season. Eight replicate plots of each community, along with a control, will be used for two separate experiments.

Treatments

Seeds of both species sown

Seeds that germinate

Seedlings of both species planted

Response Variables

germination rates

soil moisture

seedling survivorship,

height, vigor

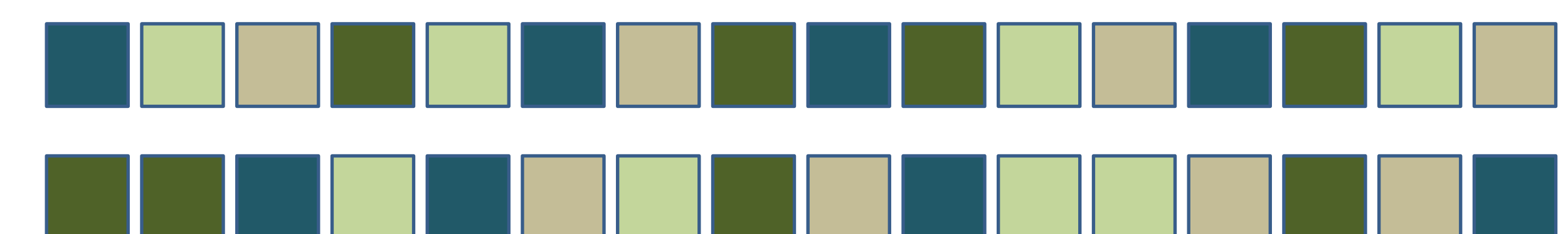
biomass

water content

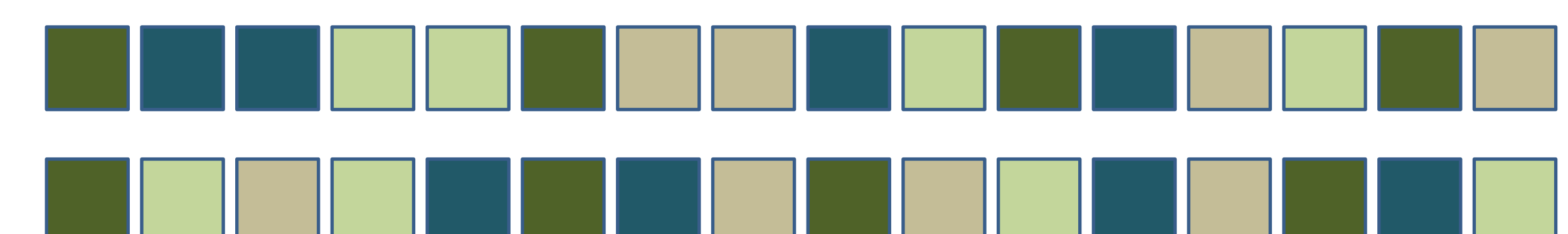
N and P content

Field and Pot Study Experiment Setup

Experiment #1: Germination study



Experiment #2: Seedling productivity study



Key:



Figure 5. Experimental design for eight randomized plots of 4 soil treatments for two field study sites and concurrent laboratory experiments. Field plot size: 32cm x 40 cm. Laboratory pot size: 10 cm d.